

Sheldrake, Sean

From: Pradeep Mugunthan <pmugunthan@anchorqea.com>
Sent: Friday, April 17, 2015 11:10 AM
To: Dana Bayuk; Coffey, Scott (CoffeySE@cdmsmith.com); Gamache, Matthew; LARSEN Henning; Sheldrake, Sean; Peterson, Lance
Cc: Mike Riley; John Edwards; John Renda; Ben Hung; Bob Wyatt; Patty Dost; Binglei Gong; Sarah Riddle; Rob Ede; Miao Zhang
Subject: RE: Gasco Modeling: Basalt No-flow Sensitivity Analysis
Attachments: Basalt Flow - USGS model.docx

Dana,

As per our discussion this morning and following the e-mails below, attached please find a discussion of the analysis used in deriving the 100 gpm flow estimate for sensitivity analysis based on the USGS model outputs. We will discuss this analysis during the source control conference call on Monday.

Thanks.
Pradeep

Pradeep Mugunthan, Ph.D., P.E.
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-----Original Message-----

From: Pradeep Mugunthan
Sent: Monday, March 23, 2015 10:02 AM
To: Dana Bayuk
Cc: Michael Riley; John Edwards; John Renda; Ben Hung; Bob Wyatt; Patty Dost; Binglei Gong; Sean Sheldrake; Peterson, Lance; Coffey, Scott (CoffeySE@cdmsmith.com); Gamache, Matthew; LARSEN Henning
Subject: RE: Gasco: Follow-up from Source Control Call on 3/12

Dana,

Our understanding of the basalt no-flow sensitivity analysis is that the 100 gpm flow from basalt to the deep lower alluvium would be in addition to the 200 to 220 gpm that enters the model at the upland boundary along HWY 30, which is also the flow estimated in the USGS Portland Basin Model. Thus, the 100 gpm flow proposed to enter from basalt to deep lower alluvium (through the zone marked up in the attachment to my email below dated 3/13) would be about 50% of the flow entering the upland boundary and 50% of the flow estimated in the USGS model. Thus, the total flow entering the alluvial units would be about 300 to 320 gpm (200 to 220 gpm from upland boundary and about 100 gpm to deep lower alluvium), which we believe would provide a reasonable upper bound sensitivity analysis. If you need further clarification please feel free to call me.

Thanks.
Pradeep

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-----Original Message-----

From: BAYUK Dana [mailto:BAYUK.Dana@deq.state.or.us]

Sent: Monday, March 23, 2015 7:35 AM

To: Pradeep Mugunthan

Cc: Michael Riley; John Edwards; John Renda; Ben Hung; Bob Wyatt; Patty Dost; Binglei Gong; Sean Sheldrake; Peterson, Lance; Coffey, Scott (CoffeySE@cdmsmith.com); Gamache, Matthew; LARSEN Henning

Subject: RE: Gasco: Follow-up from Source Control Call on 3/12

Hello Pradeep.

DEQ reviewed the March 13, 2015 e-mail (see below) you sent subsequent to our March 12th discussions on conducting a sensitivity analysis of the basalt no-flow boundary (NFB).

According to your e-mail and consistent with the March 12th discussions, NW Natural proposes evaluating the sensitivity of the basalt NFB by adding a water-bearing zone (WBZ) in the basalt between -80 and -180 COP to the model.

Based on your e-mail, DEQ understands the basalt WBZ will be setup as a general head boundary, and a steady-state simulation will be run using the average pumping rates and river stage measured during the Phase 1, Step 6 HC&C system test. DEQ further understands that the total flow entering the model at the upgradient boundary will be between 200 gpm and 220 gpm, and 100 gpm of this amount will enter the model through the basalt WBZ (i.e., 50% to 55% of the total).

DEQ requests that additional information be provided to support the proposal. Your e-mail indicates that the deep basalt flow, "...is approximately 50% higher than the flow estimated in the USGS model in the Gasco area." DEQ requests that NW Natural document this information by citing the relevant section(s) of the USGS report. Your e-mail also indicates that the 100 gpm estimate, "...provides a reasonable upper bound sensitivity analysis on the basalt flows entering the Gasco model area...." DEQ requests that NW Natural further explain the basis for this information.

The information is requested above is needed for DEQ to accept NW Natural's proposal to conduct the sensitivity analysis at the single inflow rate of 100 gpm.

Please feel free to contact me if you have questions regarding this e-mail Pradeep.

Mr. Dana Bayuk, Project Manager
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Portland, OR 97201
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From: Pradeep Mugunthan [mailto:pmugunthan@anchorqea.com]
Sent: Friday, March 13, 2015 3:33 PM
To: BAYUK Dana; LARSEN Henning; Coffey, Scott (CoffeySE@cdmsmith.com); 'Gamache, Matthew' (GamacheM@cdmsmith.com); Lance Peterson (PetersonLE@cdm.com) (PetersonLE@cdm.com); Sean Sheldrake
Cc: Michael Riley; John Edwards; John Renda; Ben Hung; Bob Wyatt; Patty Dost; Binglei Gong
Subject: RE: Gasco: Follow-up from Source Control Call on 3/12

Dana,

Please use the version of the bedrock contours attached to this e-mail instead of the one I sent a little while earlier. I inadvertently attached an older version in my e-mail below.

Thanks.
Pradeep

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From: Pradeep Mugunthan

Sent: Friday, March 13, 2015 3:24 PM

To: Dana Bayuk (BAYUK.Dana@deq.state.or.us<<mailto:BAYUK.Dana@deq.state.or.us>>); Henning Larson

(larsen.henning@deq.state.or.us<<mailto:larsen.henning@deq.state.or.us>>) (larsen.henning@deq.state.or.us<<mailto:larsen.henning@deq.state.or.us>>); Coffey,

Scott (CoffeySE@cdmsmith.com<<mailto:CoffeySE@cdmsmith.com>>); 'Gamache, Matthew' (GamacheM@cdmsmith.com<<mailto:GamacheM@cdmsmith.com>>);

Lance Peterson (PetersonLE@cdm.com<<mailto:PetersonLE@cdm.com>>) (PetersonLE@cdm.com<<mailto:PetersonLE@cdm.com>>); Sean Sheldrake

Cc: Michael Riley; John Edwards; John Renda; Ben Hung; 'Bob Wyatt'; 'Patty Dost'; Binglei Gong

Subject: Gasco: Follow-up from Source Control Call on 3/12

Dana,

As requested by you during the source control call yesterday (March 12) here is a summary of the basalt no-flow sensitivity analysis:

A basalt no-flow sensitivity analysis will be setup by adding a flow zone approximately between the -80 to -180 ft COP bedrock contours within the model domain (within the red lines in the attached figure). This zone will be setup as a general head boundary in the model to provide a target flow of 100 gpm in the steady-state simulation, which would be setup for average pumping rates and river stage during the Phase 1, Step 6 period.

As discussed in our conference call yesterday, the USGS Portland Basin Model was used to estimate groundwater flow from the basalt to the Gasco model area. This flow is applied at the upgradient boundary and is on the order of 200 to 220 gallons per minute. For the sensitivity analysis, our proposed deep basalt flow is approximately 50% higher than the flow estimated in the USGS model in the Gasco area. This provides a reasonable upper bound sensitivity analysis on the basalt flows entering the Gasco model area as well as distributing that flow to deeper alluvium layers in the model as requested by the DEQ.

Can you please let us know if DEQ approves this approach?

Thank you.

Pradeep

Pradeep Mugunthan, Ph.D., P.E.

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